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Digital Information Development in Agriculture Extension in Facing New Normal Era During Covid-19 Pandemics

Leonard Dharmawan[1], Pudji Muljono[2], Dwi Retno Hapsari[2], Bagus Priyo Purwanto[1]

[1] Vocational School of IPB University, Bogor 16128, Indonesia

[2] Department of Communication and Community Development Sciences, IPB University, Bogor 16680, Indonesia

Abstract: In the digital era, the critical issue in agricultural extension is how to develop actual information and innovations sustainably. Extension agents are often burdened by the limited information and innovations that are needed by the farmers. Many development programs planned outside the village turned out to be unfamiliar with local problems and needs; therefore, they were less effective in addressing agricultural issues experienced by the farmers. This problem was exacerbated by the Covid-19 pandemic, which made it more difficult for extension workers. The participatory action research method on the agricultural community was used in this study. New updates were offered regarding the readiness of the extension workers, who had a limitation in visiting farmers, facing the new normal era by utilizing cyber extensions or other digital information media, and other supporting media that could enable the workers to convey information progress their duties. This study also identified what kinds of digital information with messages and platforms were actually needed by the farmers to be more conducive to agricultural development in the new normal era. The result brought positive news that the extension agents were ready for the digital era and exceptionally well-equipped to educate farmers in the new normal era. Information needed by farmers is information about pest management and agricultural assistance.

Keywords: extension, information, new normal era, Covid-19

在新冠肺炎大流行期间面对新的正常时代的农业扩展中的数字信息开发

摘要：在数字时代，农业推广的关键问题是如何可持续地开发实际信息和创新。推广人员常常因农民所需的信息和创新有限而负担重。村外计划的许多发展计划结果都不是当地的问题和需求；因此，它们在解决农民所遇到的农业问题方面效果不佳。 新冠肺炎 大流行使这一问题更加严重，这使推广人员更加困难。本研究采用农业社区参与式行动研究方法。提供了有关推广人员的准备情况的新更新，这些人员在拜访农民方面遇到了限制，他们通过利用网络扩展或其他数字信息媒体以及其他可使媒体传达信息以实现其职责的支持媒体，面对新的正常时代。这项研究还确定了农民实际上需要什么样的带有消息和平台的数字信息，以更利于新常态下的农业发展。结果带来了积极的消息，推广人员已经为数字时代做好了准备，并且具备了在新的正常时代对农民进行教育的出色设备。农民需要的信息是有关虫害管理和农业援助的信息。

关键词：扩展，信息，新常态，新冠肺炎。

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About the Author: Leonard Dharmawan, Vocational School of IPB University, Bogor 16128, Indonesia; Pudji Muljono, Dwi Retno Hapsari, Department of Communication and Community Development Sciences, IPB University, Bogor 16680, Indonesia; Bagus Priyo Purwanto, Vocational School of IPB University, Bogor 16128, Indonesia

Corresponding author Leonard Dharmawan, leonarddharmawan@apps.ipb.ac.id

1. Introduction

In the digital era, a fundamental problem in agricultural extension is how extension workers or sources of information can develop innovative and actual and practical information sustainably. Extension workers are often inhibited by limited access to knowledge or information containing innovations needed by farmers as the main actors and business actors or other related parties. The problem becomes very urgent considering the government implemented a regulation stating that Extension Centers are obliged to provide and disseminate information about technology, production facilities, financing, and markets (Law No. 16 of 2006 article 15 paragraph 1c). In paragraph 1e, the Extension Center is tasked with facilitating civil servant extension workers' training and capacity building, self-help extension workers, and private extension workers through a continuous learning process. At this point, the task would be difficult or even impossible to carry out if there is no intervention program to support it.

The backwardness of the rural lower class remained challenging to overcome, even though there had been numerous agricultural innovations at a considerable cost by various parties, especially the government. Many innovative technologies produced by the Agricultural Research and Development Agency had not been appropriately adopted, especially on a large scale [1]. Many of the development programs planned outside the village did not address the problems and needs of agricultural communities in the village. They tended to be less effective in overcoming agricultural issues experienced by farmers. Numerous agricultural and technology study results were available in the form of ideas, technology, and information that have been produced by various parties. However, not all of these technologies are useful for solving actual problems faced by the farmers. This situation might be because there is no effective channel, forum, event, nor communication network connecting the stakeholders (disseminators of innovation (extension), researchers, educators, and farming communities). Each party has needs and interests that should be synergistically met. This difficulty was exacerbated by the Covid-19 pandemic, making it more difficult for extension workers to access villages to provide innovative information due to large-scale social restrictions related to the red zone of the Covid-19 pandemic. Even in the new normal era, there were still restrictions on the crowd gathering. Small farmers did not have access to gain innovative and effective alternative solutions to the problems they faced.

Furthermore, regarding extension, cyber extension with agricultural systems and information and communication technology (ICT) could be a method to solve the problem of malnutrition [2]. Some things still need to be developed in digital agriculture or cyber extensions. Digital education is especially needed in the post-Covid 19 pandemics, or the term “new normal” that we grew accustomed to; due to the limitation in the number of people involved in direct social gathering for the counseling during extension events with the farmers. Therefore, farmers should independently access information on agricultural needs according to their needs by utilizing digital information through a smartphone application or accessing a cyber web extension.

2. Literature Overview

Communication in a systems theory perspective can be explained by Cybernetics Theory, which generally comes from the information integration rubric [3]. Cybernetics is a tradition of complex communication systems where many interacting elements influence one another. Theory in the cybernetics tradition has a broader perspective on how a wide variety of physical, biological, social, and behavioral processes work. Communication is comprehended as a system that consists of parts or variables that influence one another, forming and controlling the overall system’s characteristics or traits as an organism strives towards balance. This research involved innovation in ICT utilization related to various things, including extension workers, infrastructure, farmers, innovators of communication networks, and others [4]. There are three roles of information and communication technologies: replacing humans by carrying out automation activities for a certain task or process, substituting the role of humans in presenting information, tasks, or processes, and restructuring or making changes to a task process [5]. The benefits of using information and communication technology were also conveyed by several authors [6, 7, 8, 9, 10, 11, 12, 13].

However, the perception of extension workers towards cyber extension was not good because they considered cyber extension was impractical to support agricultural extension performance. Besides, the information provided did not suit the farmers’ needs; extension personnel had difficulty accessing the slow connection of cyber extension [14]. Even farmers in Indonesia felt that there was no proper agricultural innovation information that can be used to support their

work and capacities. Regarding the innovations that have been produced and conveyed through media, such as cyber extensions, the consequences of the innovations were challenging to be measured individually; people who accepted an innovation found it difficult to feel the consequences of receiving the innovation immediately [4]. The consequences inevitably were tangled with the culture and the values in the society attached to a particular innovation. The consequences of innovations consisted of functional consequences, among others (1) high production and income, (2) high income, and (3) more enjoyment in life, and non-functional consequences; including (1) large expenditures, (2) requiring large capital, (3) unequal income and so on [4].

One of the difficulties in improving small farmers' agriculture practices was the lack of data on the market demand for vegetables concerning the type, quantity, and quality. This situation created a problem; there were abundant productions of certain crops in some areas while there were shortages in different areas. The information about current market demand is essential because, in planning the crop to plant on the farm, accurate and innovative information is needed to develop agricultural productivity. Through the analysis carried out by introducing big data to the agricultural sector, the community leaders could realize what decisions to make, where to find new income opportunities, and which product or service offerings are most likely to meet market requirements or to generate profitable industrial flows [15]. Therefore, it is possible to solve farmers' lack of information regarding market demand by providing the necessary, updated information in the cyber extension platform.

Large-scale farmers had made good use of cyber extensions so that their agricultural production capacity had developed way better than subsistence farmers. Those who had utilized cyber extensions or were able to access information via the internet independently were more likely to be successful in managing their farms even though they did not possess large land areas. The issue of technology adoption gaps related to disseminating agricultural technology innovations impacted a large gap of production yield and socio-economic constraints for farmers [16]. The low level of cyber extension utilization by the farmer respondents might be caused by language barriers, high costs, and the need to maintain the Information and Communication Technology (ICT), despite its high potential benefits. Important and urgent issues related to differences in farmers' capabilities to access information should be resolved immediately in the current and future agricultural institutions [17].

Based on the current problems surrounding cyber extension in the new normal, we formulated the following questions, including 1) How far is the extension readiness to support the implementation of the concept of a digital agricultural information system at the village level to face the new normal? 2) What kinds of platforms and digital information messages are actually needed by agricultural business actors to be more effective in realizing agricultural development in the new normal era? Through answering the formulated questions, this paper offers novel perspectives on the readiness of extension workers, who are inhibited by the limitation to visiting farmers in the new normal era, in utilizing cyber extensions or other digital information media and other supporting facilities. This research also complemented the previous progress of cyber extension research about media importance in the current new normal and digital era. Therefore, this study followed previous research by adjusting the post-Covid-19 pandemic conditions, namely the new normal. Scope of this research is about the extension (education for the community), Computer and Information Science (using ICT), use of smartphones for farmers in the community of Tugujaya village in West Java, Indonesia in a COVID-19 pandemic situation.

3. Research Methodology

This activity was carried out for four months, from July to October 2020, in Tugu Jaya Village, Cigombong District, Bogor Regency, West Java, Indonesia. Farmers in Tugu Jaya Village, Cigombong Subdistrict, were divided into nine groups consisting of seven farmers. The majority of the farmers specialized in food and horticultural commodities, and two groups of women farmers. The non-digital sources of information that can be accessed by the Tugu Jaya farmer group are agricultural extension workers and Agricultural Technology Park or Taman Teknologi Pertanian (TTP) in the village. TTP functioned to support the farmers and as well as being a model for integrated agriculture. The facility covered agriculture, animal husbandry, fisheries, and plantation crops subfields. Potential commodities in Tugu Jaya Village are eggplant, red guava, avocado, cloves, nutmeg, chilies, long beans, and coffee.

The study consisted of two parts; the first was a study to identify the readiness of extension workers and farmers to support the implementation of the agricultural digital information system concept at the village level and determine the need for digital information to face the new normal. The second was a study to formulate alternative strategies to develop an effective digital agricultural extension system. This study’s materials and tools consisted of smartphones, internet access data

packages, interview guides, cameras, and Focus Group Discussion (FGD) guidelines.

The data used in this research consisted of primary data and secondary data by employing a participatory action research method on the agricultural community. The methods used in the implementation of this research included in-depth interviews, Focus FGD, analysis of internal and external factors. Then, to test the data credibility, a triangulation test was performed by cross-checking information between extension agencies, farmer group administrators (and their members), innovation institutions, and Tugu Jaya Village officials. Also, triangulation between researchers was carried out with four research members who conducted in-depth interviews with key informants.

Data collection techniques involved interview methods, direct observation, and online. Primary data was obtained by conducting structured interviews with key informants or sources. Informants were the main actors and agricultural business actors. Key informants were the extension workers and farmer community leaders, 15 people in total, including the coordinator of the Agricultural Extension Center (Balai Penyuluh Pertanian, BPP), civil extension servant, Taman Teknologi Pertanian (TTP) staff, the local department of the Ministry of Agriculture of the republic of Indonesia (*Deptan*), farmer groups' leader, farmer group association secretary, three village officials, two farmer leaders, two young farmers and three members of the farmer group association. Secondary data were obtained from the study reports, urban village offices, and related government agencies. The research employed the snowball sampling method in determining key informants of the study. The snowball sampling technique is a sample obtained through a rolling process from one respondent to another.

The data analysis was performed by making an index of group statements that support the analysis related to the data needed to answer the problem formulation. Indexing or coding was conducted to the information related to what had been done by the extension workers to disseminate the information to farmers so far, the extension workers' readiness in facing the cyber extension, and what kind of adaptations they had prepared for the new normal. Regarding the need for digital information with messages and packaging needed by farmers, the data were grouped into several coding labels: "information access issues," "digital information needed by farmers," and "digital media commonly used." The data was then collected, analyzed, and concluded.

The processed data was then reviewed to determine the completeness and validity of the data. The validity of the information was double-checked by comparing and analyzing all the primary data from interviews, FGDs, and secondary data. In the analysis of a problem, the topic collects facts according to the unit of analysis. In the same analysis unit, the data are then separated again according to concepts related to previous research (before Covid-19) to make conclusions. The research aimed to examine the development of digital information system management in agricultural extension in the new normal era. Table 1 provides a logical framework for this research.

Table 1 The logical framework of the research

	Description	Indicator	Verification	Assumption
Objective	Role models about extension workers and agricultural business actors to support the implementation of the concept of a digital agricultural information system at the village level to face the new normal	There are research results that lead to the novelty of research results	field survey qualitative research interview and FGD	
Purpose	1) Identifying the readiness of extension workers and farmers to support the implementation of the agricultural digital information system concept at the village level to face the new normal. 2) Identifying the need for digital information with messages and packaging like what is actually needed by agricultural business actors to be more conducive to the realization of agricultural development in the new normal era.	get actual issues in the field and data that can answer these problems	field survey qualitative research interview and FGD	to get the appropriate problems and issues to be able to solve the problem of disseminating information by extension agents in the new normal era
Output	Recommendations for digital information needs with messages and platform needed by agricultural business actors to be more effective in developing agricultural sector in a normal new era.	There are research results that can increase knowledge related to digital agriculture cases in the new normal era	field survey qualitative research interview and FGD	The results of research related to cases of digital extension can be a solution, especially in the new normal era where extension workers are limited to making visits
Activity	analyzing data in the field compared to existing theories and testing the credibility of the data by checking it with triangulation method	well done research that yields findings that complement previous research	field survey qualitative research interview and FGD	research results that provide knowledge that determines policies based on field studies

4. Research Results

4.1. The Readiness of Extension Agents to Face the New Normal with Digital Information

The attempt to optimize the use of digital information media had shown progress for agricultural extension in Tugu Jaya Village. The condition of the extension officers who commuted from the red zone of Covid-19 required them to comply with the protocol for a visit to a green zone Tugu Jaya Village. The BPP extension office location was also in the red zone of Covid-19, thus

limiting extension agents from making face-to-face visits. The readiness of extension workers to support the implementation of the concept of a digital agricultural information system at the village level to face the new normal was important to continue to convey information related to agricultural innovation to Tugu Jaya Village. Currently referred to as the new normal, the condition inhibited extension workers to visit farmer groups in Tugu Jaya Village, Cigombong sub-district due to the Covid-19 pandemic. Therefore, it was needed to use digital media for coordination regarding visit schedules, assistance information, and the latest innovations to be delivered with digital media. Regarding the extension's readiness to optimize the village level's digital information system, the extension agents conveyed several things directly during the community leaders' meeting. The Tugu Jaya Village Extension Officer delivered the following:

"We, civil servants working in Agricultural Extension, especially the BPP Region VI Caringin Extension, had received training related to the cyber extension, for details, I will send the information via WhatsApp later. For its application in Tugu Jaya Village, we have provided computers for farmers in Agricultural Extension Post or *Pos Penyuluhan Pertanian* (*Posluhtan*) to use. We had divided the farmers into groups based on commodity and the area; therefore, later, when government aid would be scheduled, we could refer to the data to estimate the needs for fertilizer seeds and other production facilities. I think the extension agents' readiness for the cyber extension was adequate; it is just that it was still difficult to apply because some farmers do not even have smartphones. Farmers who have smartphones sometimes just open their cell phones in the afternoon or evening. Usually, when they are on the farm, the cellphones were used by their children or their wives. Besides that, the internet signal here (Tugu Jaya Village) was not evenly distributed; yes, in the lower land area near the village office, the internet network was good, while in the upper land area, the internet network was bad and often disappeared" (CRN, Desa Tugujaya, 23/6/2020)

The data collected by extension agents in Tugujaya Village was then inputted digitally in a system that can be accessed openly, especially by farmers. This action was in line with other studies [18, 19] about establishing big data for agriculture. The extension worker's statement about data collection and farmers' problem accessing digital data was also confirmed by the Tugu Jaya farmer group's leader, who had plotted his land with chili plants. The farmer group's leader said that his chili farm was also included in the data containing the address, land area, fertilizer requirements, and commodities. The interview with the head of the farmer group had been translated as follows:

"Yes, in here (Tugu Jaya village), not all group members were actively using smartphones, sometimes there are those who could not operate well, their children or relatives must assist them. Besides, the internet network was quite difficult to obtain in the upper land; that's why they rarely bring their cell phones to the farm. The extension worker in this village had conducted the data collection. The data collected included resident identity card or *Kartu Tanda Penduduk* (KTP) information, farmers' group name, village, land area, commodities, fertilizer needs. This information is needed to allocate government aid for farmers in this village." (HAE, Tugu Jaya Village, 27/6/2020)

Based on complete information that had been compiled from the key informants and related sources, the status of extension agents' readiness for the digital extension can be depicted by the preparation that had been carried out as follows:

1. Extension officers had participated in some activities to increase self-competence regarding the use of online extension media or cyber extensions in the form of training on data input of agricultural extension system or *Simluhtan* (*Sistem Informasi Manajemen Penyuluhan Pertanian*), compiled articles and literature on agricultural technology and innovations, inputted information related to appropriate technology in the cyber extensions, and published agricultural extension activities that had been conducted in cyber extensions.

2. Extension officers had prepared village agricultural extension posts (*Posluhtan*) that provide computers with internet for farmers to enable their independent access to agricultural technology and government aid information and data to obtain information related to innovations and develop their agricultural practices.

3. Village extension workers had developed a digital extension system, such as *Simluhtan*, that accommodates farmers' data. This digital information containing the farmer's name and other related information was used to distribute government aid, namely fertilizers. Fertilizer quota was managed based on the area of land and the cultivated commodities. To get the government aid, the farmers have to be already registered on the system and obtain a *Kartu Tani* or the farmer identification card. *Kartu Tani* served as integrated banking services (saving, transaction, and loan distribution) and proof to receive government subsidies or aid. *Kartu Tani* program had been running since 2018 with digital information basis.

4. Extension workers had formed several farming coordination groups based on their commodities through the Whatsapp® (WA) platform to manage coordination,

share information related to agricultural innovation, and facilitate consultation for farmers.

Therefore, it can be said that the extension workers in Tugu Jaya Village were ready to develop the digital extension to face the new normal. However, it appeared that the extension workers need to implement it by providing technical guidance to farmers on how to get information, consult, and share agricultural information with their fellow farmers.

There had been so much improvement in extension workers' readiness to face the digital era and utilize cyber extensions. A previous study investigating the readiness of extension workers dealt with the cyber extension and stated that extension workers were unprepared to assist farmers in utilizing cyber extensions at that time [20].

Thus, it was necessary to search for other communication media that was easier and faster to use by the farmers as a communication medium to find and exchange information about farming. Meanwhile, there was not much change with the current situation described in terms of farmers 'readiness and condition for the cyber extension. In general, the level of cyber extension utilization was still low because of farmers' lack of awareness of the existence and benefits of cyber extension and the lack of proper functioning of groups as a medium for sharing information and knowledge [20]. Table 2 provides a comparison of the conditions for readiness to use the digital extension.

Table 2 Comparison of the digital extension readiness between 2011, 2020 and expected condition

Category/ condition	Previous conditions (2011)	Present condition (2020)	The expected conditions
Extension agents' readiness in the application of the digital extension	Not ready and untrained	Ready and trained	Ready and has been applied
Infrastructure conditions for digital extension	Inadequate	Not quite evenly distributed on a mobile basis	Adequate evenly on a mobile basis
Innovation and technology support	information and innovation have not been updated	information and innovation have been updated	information and innovation have been updated
The use of the internet by extension agents to find information	not used optimally	utilization is based on big data and has utilized the internet network for its needs	utilized optimally
The use of internet by farmers to solve the problem	not yet utilized	a small proportion use it	utilized optimally
The use of the internet for farmers to innovate agriculture	not yet utilized	has not been optimally utilized	utilized optimally
The utilization of mobile applications for agricultural needs	not yet utilized	already used only to communicate between farmers to farmers and farmers to extension workers	utilized optimally
Farmers' readiness to optimize digital extension	not ready and untrained	not ready and untrained	skilled and able to make optimal use of it

4.2. The Need for Digital Information and a Platform for Agricultural Innovation Messages

Digital information with messages and platforms were needed by farmers to be more conducive to advancing agricultural development in the new normal era. The persons who work at Taman Teknologi Pertanian (TTP) revealed the following:

"There were restrictions (due to the Covid-19 pandemic) so that the extension workers could not regularly go to the village. Since the extension workers were from Bogor, which was identified as the Covid-19 red zone, they could not go to farmers as often. The TTP here also facilitates agricultural training and provides an overview to farmers about household farming, for example, planting vegetables hydroponically while raising catfish or sheep to use the animal feces as manure later. The TTP also provides large amounts of manure for farmers here at affordable prices. Farmers here rarely find their own information on the internet; usually, the extension workers would look for related information according to the needs of farmers in the TTP, because the internet network in the field, especially in the higher areas was not good" (MDR, Desa Tugujaya, 23/6/2020)

In addition to infrastructure problems, the internet signal in the area was not adequate to have smooth transmittance. The farmer groups also had issues managing and operating the internet itself; management, such as purchasing credit and software updates were unfamiliar to them; they tended to use smartphones to communicate in groups, sharing information through groups/Whatsapp® groups. Other studies discussed similar issues concerning the main weaknesses of ICT. These factors limited their use in agriculture [21], and inadequate utilization of livestock information in the case of the small dairy farmers in the dairy industry in Njoro District [22]. The Covid-19 pandemic seemed not to influence farmers' activity restrictions nor showed drastic

behavioral change. The farmer did not apply the Covid-19 prevention protocol in carrying out agricultural activities. This protocol appeared to apply only at the village office because if they did not comply with the protocol, their requests or needs would not have been served by the officers. However, in some commodities like chili, farmers experienced a negative impact from the pandemic due to the decrease in the commodity price up to IDR 7,000 per kg.

Due to the restriction in face-to-face activities/meetings applied to extension workers, farmers need information media to solve their agricultural problems. According to the head of the Tugu Jaya farmer group, the information needed is related to the following:

1. Information and data on fertilizer quota requirements for farmers based on land area and commodity needs. It is important because if the data was incorrect, the fertilizers delivered would be unused, inadequate, and not optimally utilized
2. Digital information related to the government aid concerning suitable and superior seeds that are more resistant to disease attacks from reliable and trusted sources.
3. Digital information related to handling pests and plant diseases, including the methods needed to treat pests and plant diseases according to the commodities. The disease referred to as occurs in chili plants, namely, Fusarium wilt and anthracnose (fruit rot).

Regarding how to deliver digital information (packaging the message) to the Tugu Jaya farmer groups, it would be more convenient through the Whatsapp® application in the form of a Whatsapp Group. The farmers were more comfortable sharing information through the application because it was more familiar for them. They could read the messages after getting their hands on their phones and connecting to the internet network. The use of messaging applications also occurs in the other study that adopted cellular SMS for agricultural data collection [23]. The farmers briefly do not access information through websites, e.g., e-farmer, *Deptan* web, cyber extension web, etc. They presumed that the website information was still overloaded, whereas, with Whatsapp®, the information group has been selected according to farmer groups' needs.

Connecting with the sources of innovation and sharing the information were still performed by extension agents supported by the Agricultural Technology Park. Adapting to the Covid-19 pandemic and facing the new normal era forced the farmers to use digital communication media (mobile application) to manage information about upcoming extension agents' activities and training, thus enabling them to innovate despite the decreasing meeting frequency with extension workers. However, in conducting face to face meetings, they barely obeyed the Covid-19 new normal protocol. India also has limited use of mobile applications and software to access information on the internet. The study in India described various mobile applications used around the world for different segments, including agriculture, but where their use was still limited [24]. Various agricultural mobile applications can potentially be used in agriculture and related activities, as indicated by their sources and uses. In India, there was an excellent opportunity to take advantage of smartphones to improve the agribusiness sector. The use of smartphones was essential for fast growth and easy access to information for farmers in India. The agricultural mobile application was also discussed by other authors, who stated that users wanted to be connected to the necessary information in real-time [25]. To that end, this work aimed to develop an easy-to-use mobile application, called "AMACA" (Agricultural Machinery Application Cost Analysis) to determine the cost of machines in field operations. Other studies discussed the majority of women using cell phones in marketing bananas in Nigeria [26].

5. Conclusions

The results showed that extension activities in the new normal era were carried out partly online. In facing the new normal era, the extension workers were ready for digital extension and prepared for a cyber extension with farmers. In Tugu Jaya Village, farmers experienced problems with being unable to optimize their smartphones due to infrastructure problems and limited individual capabilities. In contrast to previous studies, agricultural issues and readiness for access to agricultural information were affected by Covid-19, so the issue of maintaining technology has made farmers worse.

The information needed by farmers in Tugu Jaya Village was information related to production facilities (seeds and fertilizers) that were provided and could be accessed by them and information on the handling of pests and plant diseases in accordance with the commodities that are practically arranged by extension workers to avoid selective exposure and information overload. Extension workers and farmer groups utilized information technology by coordinating using the WhatsApp® smartphone platform to share information about agricultural practices. According to the result, we can find out that the increased knowledge and development of farming for the main players and business actors in the agricultural sector with digital innovation in the new normal era (pandemic Covid-19 situation). The results of the research can help realize effective and sustainable agricultural development. They will help extension agents to formulate alternative

strategies and develop digital communication systems in the new normal era.

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